

Name: Kelsey Carnell**James Madison University**

Mathematics and Physics with a Multidisciplinary Concentration in Technical and Scientific Communication • Bachelors of Science • May 2014

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Mentors: Mohammad S. Sabra, Nasser Barghouty

Mentor Org: USRA, NASA

**Cosmic Rays and Production of Antimatter**

High-energy protons, the dominant component of cosmic ray primaries, collide with the interstellar medium (ISM) and produce secondary particles as well as antiparticles. For cosmic-ray astrophysics as well as cosmology, we should like to be able to answer the questions as to whether the published parameterizations of the production cross sections of antiparticles in these collisions can be applied reliably and are up to date. Many researchers in the field have applied “standard” parameterizations to both old and new data, without necessarily checking their general validity and robustness. After extensive literature search of relevant cosmic-rays and high-energy particle physics published data and parameterizations, the “standard” parameterizations to be examined have been isolated. We fit the published data by manipulating these parameterizations. These studies are important for astrophysical studies in general. For example, antimatter in cosmic rays can be a probe to look for primordial black holes. Antiprotons provide information about the propagation of the proton component of the cosmic ray primaries, and are also related to the annihilation of neutralinos (postulated mass of the galactic dark matter).

Research and Experience

- **Marshall Space Flight Center**, Research Associate, Summer 2012
NSSTC: Mathematical modeling to fit data with parameterizations; Utilized new skills in digitizing data and utilized old skills in MATLAB plotting; Became proficient in literature search, the subject material, working independently and efficiently, and the research process
- **Crossroads to Brain Injury Recovery, Inc.**, Volunteer, Harrisonburg, VA, Fall 2010-Present
Work on paperwork involving the health of clients and their need for financial help
- **Virginia Department of Rehabilitation Services**, Science and Mathematics Tutor, Spring 2011, 2012
Worked one-on-one with a student suffering from memory loss
- **James Madison University**, Statistics Tutor, Harrisonburg, VA, Fall 2011
Science and Math Learning Center: Worked with students on advanced statistics and calculus
- **James Madison University**, Research Assistant, Harrisonburg, VA, Fall 2011
Astrophysics Lab: Learned about and classified galaxies
- **James Madison University**, Speaker, Harrisonburg, VA, Spring 2011
Admissions “CHOICES” Program on STEM Majors: Spoke on what the STEM program is like
- **Crossroads to Brain Injury Recovery, Inc.**, Research Assistant, Harrisonburg, VA, Fall 2010
Literature Search relating to various concentrations of brain injury in society
- **National Aquarium in Baltimore**, Exhibit Guide, Baltimore, MD, Spring 2007-Spring 2010
Learned all about the aquarium’s history and all plants, animals, and ecosystems represented

Honors, Awards

- Dean’s List, Fall 2010, Fall 2011
- Mathematics Major Scholarship, Fall 2010-Spring 2014